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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/730,966

12/08/2003

In-Woo Jang

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06/30/2004

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EXAMINER

CHEN, JACK S J

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 06/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/730,966	Applicant(s) JANG ET AL.	
	Examiner Jack Chen	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>12/8/03</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

In response to the communication filed on December 8, 2003, claims 1-14 are active in this application.

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statement filed on December 8, 2003 has been considered.

Oath/Declaration

Oath/Declaration filed on December 8, 2003 has been considered.

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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3. Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 1, step e), the phrase “the bottom electrode” is unclear; changing to –the first bottom electrode—is suggested.

Re claim 1, step g), line 2, the term “the first bottom electrodes” is unclear; changing to –the first bottom electrode—is suggested.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-4, 6, 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant’s admitted prior art in view of Joo et al., U.S./6,677,217 B2.

Applicant's admitted prior art discloses a method manufacturing a ferroelectric random capacitor, which comprises preparing an active matrix 100 including semiconductor substrate 110, a transistor, a bit line 124, a first interlayer dielectric (ILD) 122, second ILD 126 and a storage node 128 (fig. 1B); forming a first bottom electrode 130A (fig. 1B) on the active matrix; forming a third ILD 132 on exposed surfaces of the first bottom electrode and the second ILD (fig. 1C); planarizing the third ILD till a top face of the first bottom electrode is exposed (fig. 1C); forming a second bottom electrode 130B on a top face of the first bottom electrode (fig. 1D); forming a dielectric layer 134 (fig. 1F) on exposed surfaces of first bottom electrode, the second bottom electrode and third ILD; carrying out an annealing process in oxygen atmosphere (fig. 1G); and forming a top electrode 136 (fig. 1G) on the dielectric layer, see figs. 1A-1G, pages 1-6 for more details.

Re claims 2 and 3, wherein the planarizing step is carried out using a CMP technique or blanket etch technique (page 4, lines 7-15).

Re claims 8 and 9, wherein the first and second bottom electrode comprises Ir (page 4, lines 3-6 and 19-20).

Re claims 10-12, wherein the dielectric layer uses a ferroelectric material selected from SBT or PZT (page 4, line 24 to page 5, line 10), and the ferroelectric material inherently shows having a perovskite crystal structure or a layered perovskite crystal structure since this is the intrinsic properties of the ferroelectric material.

Applicant's admitted prior art discloses above; however, applicant's admitted prior art is silent to further performing an annealing process for deforming a surface of the bottom electrode before the step of forming the capacitor dielectric layer.

Joo et al. Teaches various methods for forming a capacitor, which comprises performing an annealing process for deforming a surface of the bottom electrode (i.e., forming hemispherical grain lumps) in an oxygen at about 500 °C (see abstract section and col. 2, lines 22-35) and/or nitrogen atmosphere before the step of forming the capacitor dielectric layer (col. 3, line 62 to col. 4, line 11) in order to increase the effective area for the capacitor, such will also enhance the adhesive property of the lower electrode and the capacitor dielectric; and crystallize (recovering the ferroelectric property of the capacitor dielectric) the capacitor dielectric after forming the capacitor dielectric and/or upper electrode by annealing (see col. 1, line 60-68) and further forming an upper electrode (i.e., having a single layer or plurality layers of the same material of Ru) on the capacitor dielectric; see figs. 1A-11C; cols. 1-14 for more details.

Therefore, the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to further carrying out an annealing step for deforming the surface of the lower electrode as taught by Joo et al. in the method of applicant's admitted prior art in order to increase the effective area for the capacitor, such will also enhance the adhesive property of the lower electrode and the capacitor dielectric; and select any suitable material(s) for the upper electrode in order to provide the desired conductivities; furthermore, the selection of known material(s) based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

With respect to claims 4 and 6, the claimed ranges of time and temperature in the annealing step, absent evidence of disclosure of criticality for the range giving unexpected results are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as time, temperature and concentration would have been obvious. See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

7. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art in view of Joo et al. as applied to claims 1-4, 6, 8-14 above, and further in view of Kawai et al., U.S./6,022,774.

Applicant's admitted prior art and Joo et al. disclosed above; however, both of those references are silent to further carrying out a rapid thermal process steps.

Kawai et al. Teaches a method for forming a capacitor, which comprises carrying out various annealing steps (annealing and/or RTA) at different stages for forming the capacitor in order to recover the quality of the ferroelectric layer, see figs. 1A-2H; cols. 1-8 for more details. Furthermore, using RTA method (i.e., such will lower the thermal budget) is well known in the art.

Therefore, the subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to further carrying out an annealing/RTA step after the step of patterning the upper electrode or forming the contacts as taught by Kawai et al.

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in the method of applicant's admitted prior art and Joo et al. in order to recover the quality of the ferroelectric layer. In general, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. *Ex parte Rubin 128 USPQ 159 (POBdPatApp 1959)*.

Furthermore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of applicant's admitted taken with Joo et al. and in view of Kawai et al. by selecting the suitable temperature range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)*.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jack Chen whose telephone number is (571)272-1689. The examiner can normally be reached on Monday-Friday (9:00am-6:30pm) alternate Monday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W Whitehead can be reached on (571)272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Jack Chen
Primary Examiner
Art Unit 2813